Endemic Goiter in Ohio School Children

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How much of a public health problem is goiter in the "goiter belt" states? This revealing study has the great advantage of starting from a solid base line to give an accurate answer to the question. Health people outside the midwest area will want the answer, too.

Physical examinations of men entering the United States military service in World War I revealed a widely varying incidence of simple goiter in men from different geographic areas. This information was combined with the then current data on iodine content of soil and water to determine that a natural goiter belt extends from the Appalachian Mountains westward through Ohio, Michigan, Wisconsin, Minnesota, the Dakotas, Montana, and Oregon.[1] In these states the incidence of goiter was markedly higher than in other areas and the iodine content of soil and water was extremely low.

An original experiment carried out by Marine and Kimball in Akron, Ohio, with 5,000 adolescent girls from 1916 to 1920 established the efficacy of the addition of iodides to the diet as a means of preventing simple goiter.[2] Later surveys and studies made in Ohio and adjoining states demonstrated that adding iodide to the food salt in goitrous areas is a practical method of goiter prevention. Under the auspices of the Ohio Department of Health, Kimball examined school children in several Ohio counties for goiter in 1925.[3] The results of this survey were never published, but total figures for four counties showed an incidence of 40.5 per cent goiter in girls and 24.2 per cent in boys, and an over-all incidence of 32.3 per cent.

A natural experiment involving the use of unrefined salt containing iodine was brought to public attention by a study conducted by Kimball in the Huntington and Charleston area of West Virginia in 1923.[2] Prior to 1900 residents of this area had used an unrefined salt from local salt wells which upon analysis showed an iodine content of approximately 0.01 per cent. During that period goiter had been practically unknown in the district. Soon after that date refined and free flowing salt from other states was introduced; the use of the local product was continued only for livestock. When high school girls were examined in 1923, approximately 60 per cent had visible thyroid enlargement. The publication of this study led to the practice of adding iodides to refined salt.

About 1925 salt producers began marketing food salt containing the recommended amount of potassium iodide. Ohio families were encouraged by many health and educational agencies to begin the regular use of iodized salt, but there was some opposition to its use by a few medical men who believed that it might increase the hazard of hyperthyroidism or exophthalmic goiter. A study in Michigan in 1929 of 1,229 adults with goiters of long standing showed that these fears were groundless,[4] however. Thus the general addition of iodine to the diets of many Ohioans began.

In 1951 the State Medical Society and the State Department of Health in Michigan resurveyed school children in four counties which had been surveyed

in 1923, 1928, and 1935 to determine the incidence of simple goiter. Figures reported by Brush and Altland [5] showed an over-all decline of goiter incidence in this period of from 38.6 per cent to 1.4 per cent.

Purpose of Survey

Since simple goiter is not a reportable disease in Ohio, health and medical authorities concerned with the problem of iodine deficiency and simple goiter could find in 1953 no reliable figures to indicate the present size of the goiter problem in the state. Hence, the Ohio Department of Health and the Department of Medicine of the Ohio State University jointly planned and conducted an examination of over 27,000 school children for the presence of enlarged thyroid gland. The objectives of the survey were: (1) to determine the current incidence of enlarged thyroid gland among Ohio's school children; (2) to determine the progress made since 1925 toward the control of simple goiter; and (3) to determine, if possible, some of the major factors affecting the incidence of simple goiter.

Method

As figures were available from the 1925 goiter survey only for Butler, Marion, Union, and Washington Counties, these were selected for the 1954 survey so that resulting figures could be more easily compared. Another reason for selecting these counties is that they represent three different geographic areas of the state. A representative sample of approximately 30,000 children was selected for examination in the survey areas. The cooperation and interest of local health departments, school administrators, parents, and medical societies were obtained by letter and by personal visits of district nutrition consultants of the State Health Department.

A team of two medical examiners was selected and trained by the Ohio State University College of Medicine. Criteria used for the examination were essentially those used by Kimball and other workers in previous surveys. The child was asked to lift his chin and look upward and the examiner observed the neck for visible thyroid enlargement. If no enlargement was observed the child was not examined further. If there was visible enlargement, the gland was palpated for size, consistency, and the presence of nodules. Thyroid size was graded as either normal, slightly enlarged, or moderately enlarged. All glands which were not visible, or which were visible only on deglutition, were regarded as normal. In addition, any glands which were only slightly enlarged or about which there was some doubt or disagreement between the examiners were called normal. A gland visibly enlarged to from three to six times normal size was recorded as slightly enlarged. If the enlargement was deforming, about eight to 10 times normal size, and visible with head in normal position it was termed moderately enlarged.

Prior to the examination of the children letters were sent to their parents explaining the purpose of the survey and requesting information on the use of iodized salt in the home. Answers of parents were recorded on the individual cards prepared for the children as: (1) regular users, (2) indefinite users, or (3) not at all. Each card also gave the child's name, age, sex, name of county, school, and grade. When the child was examined the examiner checked on the card the state of his thyroid gland. When it became apparent that many parents were uncer-

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tain regarding their usage of iodized salt, nutrition consultants obtained information from wholesale salt dealers and retail grocers on the use of iodized salt in the survey areas.

Results

The number of children examined and the incidence of enlarged thyroid gland found in the 1925 and the 1954 surveys are given in Table 1. The over-all incidence of enlarged thyroid gland declined from 32.3 per cent in 1925 to 4.05 per cent in 1954. Two degrees of enlargement were noted and only one-tenth of 1 per cent of the children had moderately enlarged thyroid gland. All others with enlargements were classified as slightly enlarged. Figure 1 shows the incidence of enlarged thyroid gland by age and sex. Children whose history showed regular usage of iodized salt had an incidence of enlarged thyroid gland of 3.42 per cent; whereas those not using it at all by history had an incidence of 6.06 per cent.

In Washington County a study was made of the dietary habits of 50 survey families whose children had thyroid enlargement, and an equal number of families living in the same neighborhoods whose children had normal thyroid glands. An analysis of the iodized salt usage of these two groups is shown in Figure 2. The usage of seafoods by these two groups of families is shown in Table 2. There was no significant difference in the incidence of goiter among rural children as compared with urban children.

Discussion

The marked decline in the incidence of endemic goiter in Ohio since 1925 has been verified by survey data. That the decline is due to many factors, rather than solely to the use of iodized salt, is shown by the greatly reduced incidence of enlarged thyroid gland among children whose reported usage of iodized salt is nil. Although no record was made in 1925 of the usage of seafood, it is common knowledge that improved methods of food preservation and increased facilities for the proper marketing of frozen seafoods have substantially increased the use of these foods in nearly all of the inland states during the last 10 to 15 years.

Table 1—Comparison of the Incidence of Enlarged Thyroid Gland in Ohio School Children as Shown by Goiter Surveys Made in Four Counties in 1925 and 1954

County		Total Cases Studied	Per cent Goiter Among Boys	Per cent Goiter Among Girls	Per cent Goiter All Children
Butler	1925	10,679	22.0	41.0	31.5
"	1954	12,905	1.8	4.2	3.0
Marion	1925	5,352	28.5	37.8	33.1
"	1954	4,231	2.3	7.2	4.6
Union	1925	1,302	18.0	44.0	31.0
"	1954	1,412	2.8	7.7	5.2
Washington	1925	4,247	28.4	39.2	33.8
"	1954	3,854	2.9	9.3	5.9
Total	1925	21,580	24.2	40.5	32.3
	1954	22,402	2.2	5.8	4.0

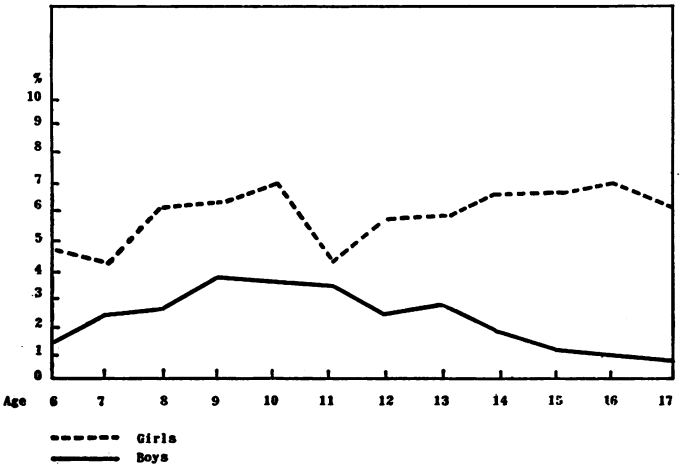

Figure 1—Ohio Goiter Survey—1954, Incidence of Enlarged Thyroid Gland by Age and Sex

Thus it is not surprising to note in Table 2 that a large percentage of families use seafoods once every two weeks or oftener. Because these foods vary considerably from one variety to another in iodine content and children do not always eat well of the seafood group, it is difficult to estimate the amount of iodine obtained from this source. Other possible sources of dietary iodine in Ohio include milk and eggs from animals fed a ration containing iodine and vegetables marketed in Ohio grown in states where the soil contains iodine. It has long been recognized that certain foods of the cabbage family appear to have a goitrogenic effect upon human beings when consumed in relatively large quantities. Little is known of the extent of decrease, if any, in the usage of these foods in Ohio.

Figure 1 shows a substantially higher incidence of goiter in girls over boys at all ages, although the difference is greatest in the ages 14 to 17 years. This difference in the sexes during puberty was noted in the 1925 Ohio survey and is confirmed by data from a survey conducted recently in El Salvador and reported by Cabezas, et al.[6] No satisfactory explanation has been found for the marked difference in goiter incidence in the sexes during the prepubertal years.

If the incidence of enlarged thyroid

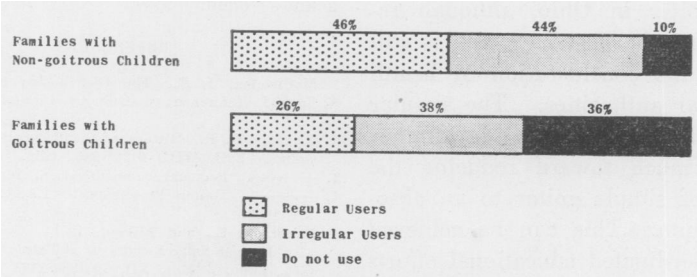

Figure 2—Usage of Iodized Salt, Washington County, Ohio, Survey Families—1954

Table 2—Comparison of the Consumption of Seafood by Washington County, Ohio, Goiter Survey Families—1954

Consumption of Seafood	Families with Goitrous Children	Families with Non-goitrous Children
	Per cent	Per cent
More than once weekly	0	4
Once weekly	16	24
Once every two weeks	38	38
Once monthly	28	16
Once in two months	14	14
Once or twice yearly or not at all	4	4

gland in the 27,547 school children examined can be assumed to be representative of the incidence of simple goiter throughout the state, Ohio has about 80,000 children with thyroid enlargement. If this group is fairly representative of the total population, the state has an estimated total of 320,000 cases of enlarged thyroid gland. A very high percentage of these are not noticeable enlargements and may, therefore, never come under the supervision of a physician. In the younger age groups it is possible that many will disappear with the added dietary iodine that is often obtained from a varied diet. Other cases will not be treated either directly or indirectly and will result in suboptimal health for these individuals.

It is apparent that the problem of endemic goiter in Ohio, although reduced during the past 29 years, is still worthy of the consideration of health and medical authorities. The regular use of iodized salt by all Ohio families would do much toward reducing the incidence of simple goiter to an absolute minimum. This can be achieved only by coordinated educational efforts of health and educational agencies and medical societies.

Summary

More than 27,000 school children were examined for endemic goiter in four counties in Ohio. Of these, 4.05 per cent were found to have enlarged thyroid gland. This was determined to be a reduction in goiter incidence in 29 years from about one in three to about one in 25. The incidence of thyroid enlargement in girls was higher than in boys at all ages, although the difference was more pronounced in adolescence. Children from homes where iodized salt was reported to be used regularly had an incidence of goiter of 3.42 per cent; while those from homes reporting no use of iodized salt had an incidence of 6.06 per cent.

On the basis of survey data it is estimated that 80,000 school children and 320,000 of the total population in Ohio have some degree of thyroid enlargement, although the number of noticeable enlargements is very small. It is obvious that endemic goiter is still a public health problem in Ohio, although a minor one. Educational efforts are needed to promote an increased and more uniform usage of iodized salt and other sources of food iodine.

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